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EXAMINER

TAMAI, KARL I

ART UNIT PAPER NUMBER

2834

DATE MAILED: 12/11/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

## Application No.

09/481,803

## Applicant(s)

TAVKHELIDZE ET AL.

## Examiner

Tamai IE Karl

## Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 23 October 2002.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-4,6-10,13-17,23-37,50-62 and 65-68 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 6 is/are allowed.
- 6) ☒ Claim(s) 1-4,7-10,13-17,23-34, 36, 37,50-62, 65, 67, and 68 is/are rejected.
- 7) ☒ Claim(s) 35 and 66 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

**DETAILED ACTION**

***Drawings***

1. The objection to the drawings is withdrawn.

***Claim Rejections - 35 USC § 102***

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

3. Claims 1-2 and 7 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by Kennel (US 5410166). Kennel teaches a thermal conversion device having a source of electron tunneling (voltage source) connected to the emitter which when pulsed, produced an electron tunnel to the anode 104, where the anode can be manipulated at 108. The electrons being tunneled from the emitter to the anode 104 across a small gap 110. Kennel teaches the emitter and collector connected a circuit as a thermionic generator or switch. The thermionic generator being in a housing 102 is flexible to allow the movement of the manipulating means and the anode 104. It is

inherent that the manipulator 108 includes some form of means for assessing the electrode distance.

4. Claims 1, 2, 4, 7, 23, and 24 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by Hatsopoulos and Gyftopoulos (H&G). H&G teach a thermionic diode having a flat emitter and collector. H&G teach a manipulator(spacing adjustment mechanism) to control the relative spacing of the electrodes. It is inherent that a power converter is connected to an electrical load. H&G teaches a thermionic converter in a vacuum housing which is flexible to allow the movement of the electrodes. H&G shows the electrode adjustment means which is activated by a human and which inherently can determine the spacing of the electrodes. It is inherent that the spacing between the electrodes is sufficiently small to allow for electron tunneling.

5. Claims 1, 2, 8, 10, 13-16, 23, 24, and 27 are rejected under 35 U.S.C. 102(e) as being clearly anticipated by DiMatteo (US 6,084,173). DiMatteo teaches an energy converter having an emitter 1 connected to a heat source and a collector 2 connected to a cool source, which is connected to a circuit as photovoltaic (sunlight) generator and is inherently positioned in a flexible housing which allows the adjustment of the electrodes. DiMatteo teaches piezoelectric actuators to adjust the position of the electrodes, which inherently includes a control means for the electrodes.

6. Claims 23 and 28 are rejected under 35 U.S.C. 102(e) as being clearly anticipated by Rason et al.(Rason)(US 3,843,896). Rason teaches a diode with flat matching surfaces between the electrodes. Rason teaches the emitter and collector made from different materials, which inherently have different coefficients of thermal expansion.

7. Claims 1, 2, 7-10, 13, 14, 23, 24, 27, 50, 53, and 61 are rejected under 35 U.S.C. 102(b) as being clearly anticipated by Fitzpatrick et al. ("Close-Spaced Thermionic Converters with Active Spacing Control and Heat Pipe Isothermal Emitters). Fitzpatrick teaches a thermionic generator with matching emitters and collectors having flat surfaces. The spacing is controlled by piezoelectric motors and the spacing is measured by measuring the capacitance, where the distance separating the electrodes is always controlled by the control means. It is inherent that the electrodes are space sufficiently small to allow electron tunneling therebetween to allow the device to operate as a generator. The generator having hot and cold heat pipes connected to the emitter and collector. Fitzpatrick teaching the heat energy can be solar.

8. Claims 23, 33, and 65 are rejected under 35 U.S.C. 102(e) as being clearly anticipated by Cox (US 6,064,137). Cox clearly teaches two opposing electrodes with matching surfaces and having a second removable material which is removed by a solution and a vacuum.

***Claim Rejections - 35 USC § 103***

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

10. Claims 3 is rejected under 35 U.S.C. 103(a) as being unpatentable over H&G, Kennel, Fitzpatrick, or DiMatteo, in further view of Rason et al.(Rason)(US 3,843,896). H&G, Kennel, and DiMatteo, each individually teach every aspect of the invention except the housing being thermally conductive with the collector thermally connected to the housing. Rason teaches a conductive housing to allow heat to pass in and out of the converter. It would have been obvious to a person of ordinary skill in the art at the time of the invention to construct the energy converter of H&G, Kennel, or DiMatteo with the conductive housing of Rason to allow heat pass into the energy convert to generate electricity.

11. Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over DiMatteo, in further view of Cox(US 6,6064,137). DiMatteo teaches every aspect of the invention except a voltage source to operate the device as a heat pump. Cox teaches it is know to provide a voltage source 23 to a thermionic converter to operate the device as a heat pump. It would have been obvious to a person skilled in the art at the time of the invention to construct the converter of DiMatteo with the voltage source of Cox to operate the device as a heat pump.

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12. Claims 25, 26, and 54-56 are rejected under 35 U.S.C. 103(a) as being unpatentable over DiMatteo or H&G or Fitzpatrick. DiMatteo and H&G, each individually teach every aspect of the invention except the collector and emitter positioned within 200, 100, or 10 angstroms. It would have been obvious to a person skilled in the art at the time of the invention to construct the diode of DiMatteo or H&G with the electrode spacing of 200 or 100 angstroms to provide and small air gap to reduce thermionic leakage around the collector.

13. Claims 28-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fitzpatrick, in further view of Richards(US 4,281,280) and Edelson(US 5,874,039). Fitzpatrick teaches every aspect of the invention except the collector being aluminum and emitter being titanium with a difference of thermal expansion being 4-1. Richards teaches aluminum is a known anode material. Edelson teaches titanium is a known emitter material. It would have been obvious to a person skilled in the art at the time of the invention to construct the energy converter of Rason with the aluminum anode of Richards and the titanium emitter of Edelson because mere selection of known parameters is within the ordinary skill in the art and because Richards and Edelson teaches the materials are sufficient for electrode structures in thermionic converters.

14. Claims 29-32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rason, in further view of Richards(US 4,281,280) and Edelson(US 5,874,039). Rason and Fitzpatrick teach every aspect of the invention except the collector being aluminum

and emitter being titanium with a difference of thermal expansion being 4-1. Richards teaches aluminum is a known anode material. Edelson teaches titanium is a known emitter material. It would have been obvious to a person skilled in the art at the time of the invention to construct the energy converter of Rason or Fitzpatrick with the aluminum anode of Richards and the titanium emitter of Edelson because mere selection of known parameters is within the ordinary skill in the art and because Richards and Edelson teaches the materials are sufficient for electrode structures in thermionic converters.

15. Claim 34 is rejected under 35 U.S.C. 103(a) as being unpatentable over Cox. Cox teaches every aspect of the invention except positioning the electrodes within 200 or 100 angstroms. It would have been obvious to a person skilled in the art at the time of the invention to construct the diode of Cox with the electrode spacing of 200 or 100 angstroms to provide an efficient and small air gap to reduce thermionic leakage around the collector.

16. Claims 36 is rejected under 35 U.S.C. 103(a) as being unpatentable over Cox in further view of Fitzpatrick et al. ("Close-Spaced Thermionic Converters with Active Spacing Control and Heat Pipe Isothermal Emitters). Cox teaches every aspect of the invention except the moveable electrodes Fitzpatrick teaches movable electrodes to provide high power densities. It would have been obvious to a person of ordinary skill in



the art at the time of the invention to construct the generator of Cox with the moving electrodes of Fitzpatrick to provide high density output.

17. Claim 37 is rejected under 35 U.S.C. 103(a) as being unpatentable over Fitzpatrick (US 4,667,126)('126) and Fitzpatrick ("Close-Spaced Thermionic Converters with Active Spacing Control and Heat Pipe Isothermal Emitters). '126 teaches a thermionic converter with an electrodes space spaced apart in an inert gas with the electrode thermally adjustable (col. 4, lines 17-19) where the thermally activated member 38 is connected to the face of the electrode 24. '126 does not teach a electroactive, magnetostrictive, or piezoelectric control of the electrode spacing or a spacing of 1-100 angstroms. Fitzpatrick teaches the gap adjustor being a piezoelectric device. It would have been obvious to a person skilled in the art at the time of the invention to construct the converter of '126 with the piezoelectric drive of Fitzpatrick to provide improved control of the gap due to vibrations, and with the gap space of 1-100 angstroms to optimize the efficiency of the converter (see *In re Aller*, 105 USPQ 233, holding where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art).

18. Claim 51 is rejected under 35 U.S.C. 103(a) as being unpatentable over Fitzpatrick ("Close-Spaced Thermionic Converters with Active Spacing Control and Heat Pipe Isothermal Emitters) and Richards(US 4281280). Fitzpatrick teaches every aspect of the invention except the measuring means being an apparatus for measuring

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tunneling current. Richards teaches the output of a thermal generator is controlled by monitoring the output voltage or current. It would have been obvious to a person of ordinary skill in the art at the time of the invention to construct the machine of Fitzpatrick with an ammeter and the control means because Richards teaches that the generator can be controlled to provide an optimum output.

19. Claim 52 is rejected under 35 U.S.C. 103(a) as being unpatentable over Fitzpatrick ("Close-Spaced Thermionic Converters with Active Spacing Control and Heat Pipe Isothermal Emitters) and Sliwa Jr. (US 5307311). Fitzpatrick teaches every aspect of the invention except the measuring means being an optical interferometry. Sliwa teaches the equivalence of optical interferometry and capacitance sensors in positioning piezoelectric micro-actuators. It would have been obvious to a person of ordinary skill in the art at the time of the invention to construct the machine of Fitzpatrick with an optical interferometry because Silwa teaches that optical interferometry is used to control piezoelectric actuators and because it is within the ordinary skill in the art to choose between know equivalents.

20. Claims 57-60 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fitzpatrick ("Close-Spaced Thermionic Converters with Active Spacing Control and Heat Pipe Isothermal Emitters), as discussed above, and Richards(US 4281280). Fitzpatrick teaches every aspect of the invention except the region between the electrodes being evacuated or having an inert gas such as argon. Richards teaches the region between

the electrodes can be either evacuated or filled with an inert gas such as argon. It would have been obvious to a person of ordinary skill in the art at the time of the invention to construct the machine of Fitzpatrick with the region between the electrodes being evacuated or filled with argon because Richards teaches that the vacuum or argon allows the electrons in the gas to be charged and flow between the electrodes when heat is applied to the cathode.

21. Claim 61 is rejected under 35 U.S.C. 103(a) as being unpatentable over Fitzpatrick ("Close-Spaced Thermionic Converters with Active Spacing Control and Heat Pipe Isothermal Emitters) and Cox, as discussed above, and Richards(US 4281280). Fitzpatrick and Cox teach every aspect of the invention except the inert gas being argon. Richards teaches the region between the electrodes can be either evacuated or filled with an inert gas such as argon. It would have been obvious to a person of ordinary skill in the art at the time of the invention to construct the machine of Fitzpatrick and Cox with the region between the electrodes being evacuated or filled with argon because Richards teaches that the vacuum or argon allows the electrons in the gas to be charged and flow between the electrodes when heat is applied to the cathode.

22. Claim 67 and 68 are rejected under 35 U.S.C. 103(a) as being unpatentable over Cox. Cox teaches every aspect of the invention except second material being lead and the third material is aluminum. It would have been obvious to a person skilled in the art at the time of the invention to construct the diode of Cox with the second material being

lead and the third material is aluminum as a matter of design choice to optimize the manufacture of the generator.

***Allowable Subject Matter***

23. Claim 6 is allowed.

24. Claims 35 and 66 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

***Response to Arguments***

25. Applicant's arguments filed 10/25/02 have been fully considered but they are not persuasive. The examiner notes that claims 43-49, 63, and 64 have been cancelled by an amendment filed 10/25/02 and claims 5, 11, 12, 18, 21, and 22 were cancelled by the amendment filed 12/21/01 which was entered with the RCE on 4/3/02.

The Applicant's argument regarding Kennel is not persuasive. Claim 1 requires electrons to be tunneled from the emitter to the collector. Kennel teaches the emitters are the diamond elements 134 (col. 5, line 34-46). The electrons are injected into the emitters from the N type regions 136 of the substrate 134, then emitted from the elements 134 into the air gap and on to the anode. The transmission of the electrons from the emitters to the anode is inherently electron tunneling. The Applicant's argument that there is not air gap is not persuasive. There is a space 110 between the anode 104 and the emitters which is inherently an air gap. The air gap may be filled with cesium to enhance electron emission, but that does not change the fact that the space 110 is an air gap. The Applicant's argument regarding the thermotunnel

disclosed in the specification is not persuasive. First, limitations from the specification are read into the claims. Second, the specification merely teaches that a thermoelectric and thermionic converters are thermo tunnels, and Kennel teaches a thermionic converter which the specification admits is a thermotunnel. The Applicant's argument regarding the space between the emitter and collector is not persuasive, because the space is clearly disclosed as element 110. The rejection is proper and maintained.

The Applicant's arguments regarding the spacing of H & G is not persuasive. H & G clearly teaches a thermionic converter where electrons are tunneled across an air gap from the collector to the emitter. Thermionic conversion between the emitter and collector can only take place if the electrodes are sufficiently close together, therefore, it is inherent that spacing is sufficiently small to allow tunneling or thermionic conversion. The Applicant's argument regarding the thermotunnel disclosed in the specification is not persuasive. First, limitations from the specification are read into the claims. Second, the specification merely teaches that a thermoelectric and thermionic converters are thermo tunnels, and H&G teaches a thermocouple which the specification admits is a thermotunnel. The Applicant's arguments regarding claims 23 and 24 are not persuasive. The drawings clearly show to flat surfaces on the collector and emitter which are facing each other, which is operated as a thermionic power converter. The rejection is proper and maintained.

The Applicant's argument regarding Dimatteo is not persuasive. As stated above, it is inherent that the spacing between the electrodes is sufficiently small to allow tunneling or the device would not operate as a thermionic converter. Dimatteo further

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includes a disclosure of the spacing being in the .01-20 microns. The rejection is proper and maintained.

The Applicant's argument regarding Fitzpatrick is not persuasive. As stated above, it is inherent that the spacing between the electrodes is sufficiently small to allow tunneling or the device would not operate as a thermionic converter. The Applicant's argument regarding the replicated surface variations of the electrodes is not persuasive because the limitation has not been claimed. The rejection is proper and maintained.

The Applicant's argument regarding Cox is not persuasive. The Applicant's argument regarding the duplication of minor surface variations from one surface to the other has not been claimed. The rejection is proper and maintained.

### ***Conclusion***

26. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Karl I.E. Tamai whose telephone number is (703) 305-7066.

The examiner can be normally contacted on Monday through Friday from 8:00 am to 4:00 pm. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mr. Nestor Ramirez, can be reached at (703) 308-1371. The facsimile number for the Group is (703) 305-3432.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956.

Karl I Tamai  
PRIMARY PATENT EXAMINER  
December 9, 2002



KARL TAMAI  
PRIMARY EXAMINER